Rabies (Human and Animal)

(Also known as Hydrophobia)

Report Human Cases Immediately

March 2004 HighPoint

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

The virus that causes rabies is a rhabdovirus of the genus *Lyssavirus.*

B. Clinical Description and Laboratory Diagnosis

Animal Rabies

Rabies is an acute viral encephalomyelitis that principally affects bats and carnivores, although all mammals are susceptible. Classically, clinical signs may appear in two phases: excitative or "furious" and/or paralytic or "dumb". In the furious stage, the animal displays uncharacteristically aggressive behavior and may bite at inanimate objects. The paralytic stage is characterized by depression, unresponsiveness and ascending paralysis. In either form, prodromal signs may include unusual vocalization, wobbly gait, tremors and abnormal behavior (i.e., a wild animal may approach humans without fear). The end stages of disease are paralysis, coma and death. The time period between onset and death is typically less than 10 days. The behavior of an animal, however, is *not* a reliable indicator of whether it has rabies.

Laboratory diagnosis is based upon direct fluorescent antibody test (DFA) performed on brain tissue of the animal.

Human Rabies

Rabies is almost always a fatal infection. A progressive illness of approximately 2–21 days follows an incubation period of usually 3 – 8 weeks. A prodromal phase, lasting about 2–10 days, is characterized by pain and numbness/tingling at the site of the bite (present in 50–80% of cases) and nonspecific complaints such as fatigue, headache and fever. Behavioral changes may also be apparent, including apprehension, anxiety, agitation, irritability, insomnia and depression.

The prodromal phase is followed by the neurologic phase, which is characterized by disorientation and hallucinations, paralysis, episodes of terror and excitement, hydrophobia, hyperventilation, hypersalivation, and seizures. These symptoms are followed by coma and death. Once symptoms have begun, the disease is invariably fatal, despite treatment.

Several tests are necessary to diagnose rabies ante-mortem (before death) in humans; no single test is sufficient. Specimens for rabies testing should be collected only after more common etiologies of encephalitis or myelitis have been ruled out, in consultation with the NJDHSS Infectious and Zoonotic Disease Program (IZDP) (See section 2 B. for more information). Tests are performed on samples of saliva, serum, spinal fluid, and skin biopsies of hair follicles at the nape of the neck. Saliva can be tested by virus isolation or reverse transcription followed by polymerase chain reaction (RT-PCR). Serum and spinal fluid are tested for antibodies to rabies virus. Skin biopsy specimens are examined for rabies antigen in the cutaneous nerves at the base of hair follicles.

C. Reservoirs

Although all species of mammals are susceptible to rabies virus infection, only a few species are important in maintaining the disease cycle in nature. In the United States, raccoons, skunks, foxes and coyotes are the major reservoirs in terrestrial animals, with bats being the other animal reservoir. Two variants of rabies virus are present in New Jersey, bat and raccoon. In contrast to the United States and Europe, dogs remain the principal reservoir of rabies in developing countries. Any of the rabies variants can be passed to other animals and humans through exposure to contaminated saliva. Small rodents and lagomorphs (*e.g.*, squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, mice, wild rabbits and hares) have not been known to transmit rabies to humans and are almost never found to be infected with rabies. The exceptions are rodents and lagomorphs (specifically domestic rabbits) caged outdoors, since cages often allow exposure to rabid animals while still providing enough protection for the rabbit to survive and go on to develop the disease. Also, a significant number of groundhogs (considered a large rodent) have been found to be rabid in the Mid-Atlantic States. For this reason they are considered a high-risk animal despite the fact that they are rodents.

D. Modes of Transmission

Rabies is transmitted when the virus-laden saliva or other potentially infectious material (brain, spinal cord) of an infected animal is introduced into bite wounds, open cuts in the skin or onto mucous membranes. Bites by some animals, such as bats, can inflict injury so minor that it may go undetected. Also, indirect exposure to saliva of a rabid animal can occasionally occur through contact with a pet or other object. Direct person-to-person transmission is theoretically possible but cases occurring under such conditions have not been documented. However, there have been cases documented after corneal transplants from infected individuals. Airborne spread in specific situations (i.e., in a cave with a multitude of bats or in a laboratory with rabies virus or specimens) has occurred. Rabies is not transmitted through contact with blood, urine, skunk spray, or feces of an infected animal. Because rabies virus is rapidly inactivated by desiccation and ultraviolet irradiation, if the material potentially containing virus is dry to the touch, it can be considered noninfectious.

E. Incubation Period

Animal Rabies

Depending on the animal, dose of virus and site of inoculation, the incubation period may vary from 12 days to one year or more, but is typically 1 to 3 months. Some animals, such as dogs and cats, have been studied extensively, and the incubation period of these animals rarely exceeds 6 months.

Human Rabies

The incubation period is usually 3 to 8 weeks, but can be as short as 9 days although 9-day incubation periods have not been documented in the United States with native strains, or as long as 7 years. Less than 1% of human cases have an incubation period longer than 6 months. The incubation period is typically related to the site of exposure, *e.g.*, the incubation period is usually shorter if the virus is inoculated closer to the central nervous system or in an area that is highly innervated (such as the hand). The incubation period also depends on the severity of exposure (more virus results in a shorter incubation period).

F. Period of Communicability or Infectious Period

Animal Rabies

Animals are not infectious until virus appears in their saliva, which occurs at or near the end of the incubation period. Dogs, cats and ferrets may shed virus for up to 3–4 days before the onset of

clinical signs and continue throughout the course of illness, usually 10 days or less. The shedding/communicability period for most wild animals has not been determined, although it has been demonstrated that skunks may shed virus up to 18 days before death. Carcasses of animals with rabies may contain infectious virus, depending on temperature and environmental conditions. Rabies virus may persist in a frozen carcass for many weeks. Because drying and sunlight exposure rapidly deactivate rabies virus, a desiccated or decomposed carcass would not contain live rabies virus.

Human Rabies

The period during which a patient is considered infectious begins up to 10 days before symptom onset and last until death. Saliva is considered potentially infectious, as are other bodily tissues and fluids. It should be noted, however, that with the exception of corneal transplants from infected persons, there have been no documented cases of person-to-person transmission of laboratory-confirmed rabies.

G. Epidemiology

Animal Rabies

Animal rabies exists in most parts of the world. In the United States, Hawaii is the only state that has never reported an indigenously acquired rabies case in humans or animals. Most of the continental United States has enzootic rabies in terrestrial mammals; bat rabies is enzootic in Alaska as well as throughout the continental United States. Wild animals accounted for nearly 93% of reported cases of animal rabies in the United States in 2001. Raccoons continued to be the most frequently reported rabid wildlife species (37% of all animal cases during 2001), followed by skunks (31%), bats (17%), foxes (6%), and other wild animals (2%). Dogs are a primary reservoir for rabies in Mexico and much of Central and South America, Asia, and Africa. In the United States, children are exposed to rabid and potentially rabid animals more often than are adults.

In New Jersey, the terrestrial (raccoon) rabies epizootic began in 1989, with peak years in 1991 and 1992. Rabies moves in cycles through the animal population. Summer months are peak months for exposures to animals, as people and animals are both outside and likely to encounter each other. From 1989 through 2003, 4,650 animals tested positive for rabies, including 235 cats and 4 dogs. Nearly all towns in New Jersey have had animal rabies cases during this time period.

Human Rabies

In the United States over the past century, the number of human deaths attributed to rabies has declined from 100 or more each year, to an average of three each year. The decline is due to pet vaccination and animal control programs begun in the 1940s that have practically eliminated the domestic dog as a reservoir of rabies, and to the development of effective human rabies vaccines and immune globulin. Since 1990, 37 human rabies deaths in the United States have been reported to the Centers for Disease Control and Prevention (CDC), with 26 of those associated with bat variants. Seven of these deaths are believed to have been caused by contact with rabid animals (mostly dogs) outside the United States. Worldwide, an estimated 40,000 human rabies deaths occur each year. The vast majority of these deaths occur in developing countries from exposure to rabid dogs. The last indigenous case of human rabies in New Jersey was in 1997 in a man who had contact with bats, and was caused by the silver-haired /pipistrelle bat strain. The last case prior to that was in 1971 and was due to incomplete post-exposure treatment following a bat bite.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. New Jersey Department of Health and Senior Services (NJDHSS) Human Case Definition

CASE CLASSIFICATION

CONFIRMED
Clinically compatible case, **AND**

- Detection by direct fluorescent antibody of viral antigens in a clinical specimen (preferably the brain or the nerves surrounding hair follicles in the nape of the neck), **OR**
- Isolation (in cell culture or in a laboratory animal) of rabies virus from saliva, cerebrospinal fluid (CSF), or central nervous system tissue, **OR**
- Identification of a rabies-neutralizing antibody titer ≥5 (complete neutralization) in the serum or CSF of an unvaccinated person.

PROBABLE
Not used.

POSSIBLE
Not used.

B. Laboratory Testing Services Available

Animal Rabies
Animals are tested at the New Jersey Public Health and Environmental Laboratories (PHEL) using the direct fluorescent antibody test. Local health departments (LHD) must make arrangements for transport of specimens to the PHEL. Animal control officers and veterinarians need to be familiar with the proper way to euthanize, prepare and properly submit animals to the laboratory. Except for whole bats and other animals less than two pounds, only animal heads will be accepted for rabies testing. For more information on submitting specimens, contact the NJDHSS (IZDP) at 609.588.3121 or check the New Jersey Guide to Postexposure Rabies Treatment for the Health Care Professional on the NJDHSS website. All animal test results performed at the PHEL are reported to the LHDs via fax; all positive reports are telephoned to the LHD immediately.

Human Rabies
Contact the IZDP at 609.588.3121 for human specimen testing approval and specific instructions regarding the types of specimens to submit and the proper methods for submission. All clinical samples from suspect cases of human rabies must be sent to the PHEL for forwarding to the CDC for testing.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To develop knowledge of the vector species in the New Jersey and the relative incidence of rabies in this and other species.
- From the above, develop educational information for the public, so that they may avoid contact with the vector species.
- Prompt reporting of animal bites to animal control officers can help prevent rabies, unnecessary treatment, and the needless killing of pets by insuring appropriate quarantine.

B. Laboratory and Healthcare Provider Reporting Requirements

Human Rabies

Due to the rarity and potential severity of human rabies, the NJDHSS requests that information about any known case of human rabies be **immediately reported** to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located. If this is not possible, call the NJDHSS IZDP at 609.588.3121 or 588.7500 (weekdays), or 609.392.2020 (emergency number for nights/weekends). A telephone report shall be followed by a written or electronic report within 24 hours of the initial report.

Normally, a confirmed human rabies diagnosis will not be made without the extensive involvement of the NJDHSS.

Reporting of Administration of Rabies Post-Exposure Prophylaxis

The administration of rabies post-exposure prophylaxis (PEP), which is rabies vaccine and/or human rabies immune globulin, is reportable to the local health officer by the healthcare provider using NJDHSS Report of Rabies Post-Exposure Treatment Form (NJDHSS website). Please remind healthcare providers of this requirement.

Animal Rabies

Suspected rabies in animals is reportable to the local health officer. The local health officer will be informed about results of all animal testing for rabies within his/her jurisdiction done by the PHEL.

Animal Bites

Animal bites are reportable to the local health departments, not the NJDHSS IZDP. However, NJDHSS IZDP staff is available for consultation on animal bite management regarding possible rabies exposures.

C. Local Health Departments Reporting and Follow-Up Responsibilities

1. **Reporting Requirements**

   The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that each local health officer must report the occurrence of any case of human rabies, as defined by the reporting criteria in Section 2 A above. Current requirements are that cases be **immediately reported** to the NJDHSS IZDP.

2. **Case Investigation**
   a. **The most important step a local health officer can take if he or she learns of a suspect or confirmed case of human rabies is to immediately call the NJDHSS** at 609.588.3121 or 588.7500 (weekdays), or 609.392.2020 (emergency number for nights/weekends).

   b. The NJDHSS IZDP will direct case investigation of human rabies in New Jersey.

   c. Following immediate notification of the NJDHSS, the health officer may be asked to assist in investigating any suspect case within their community, including gathering the following:
      1) The patient's name, age, address, phone number, status, and parent/guardian information, if applicable.
      2) The name and phone number of the hospital where the patient is, or was, hospitalized.
      3) The name and phone number of the patient's attending physician.
      4) The name and phone number of the infection control official at the hospital
      5) If the patient was seen by a healthcare provider before hospitalization, or was seen at more than one hospital, get contact names and telephone numbers.
      6) History of travel outside the United States within one year.
      7) History of bites, scratches, or other exposure to animals within the past year.
      8) **If CDRS is used to report, enter this collected information into the "Comments" section.**

   d. Institution of disease control measures is an integral part of case investigation. It is the local health officers' responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4, "Controlling Further Spread."

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (N.J.A.C. 8:57-1.10)

Minimum Period of Isolation of Patient
For the duration of illness, since most cases are fatal.

Minimum Period of Quarantine of Contacts
Prophylaxis of people exposed to the patient. Exposed animals should either be euthanized immediately or appropriately isolated and vaccinated. Additional information is found in the next section, below.

B. Managing Rabies Situations

Protection of Humans Exposed to a Rabid or Potentially Rabid Human
Contact isolation for respiratory secretions should be in place for persons suspected or confirmed to have rabies. Articles soiled with saliva should be disinfected. Attending personnel should be protected (gloves, gowns, face protection) against any exposure to saliva. If a patient who has rabies (or is suspected of having rabies) exposes another person via his/her saliva (through a bite, an open wound or a mucous membrane), rabies post-exposure prophylaxis of the contact should be considered. Once a patient is diagnosed with rabies, other people from the patient's home or work environment should be interviewed by the local heath department to determine their exposure risk.

Protection of Humans Exposed to a Rabid or Potentially Rabid Animal

N.J.S.A. 26:4-79, 80, and 81 establishes that all animal bites or attacks are reportable to the local health department. Domestic animals (*i.e.*, dogs, cats, ferrets and domestic livestock) that have bitten, scratched, or otherwise exposed a human and appear healthy may be quarantined for 10 days in lieu of euthanasia and testing. Dogs, cats and ferrets that are incubating rabies will begin to exhibit signs of the disease very soon after they begin shedding virus in their saliva and die within 7 days, so a 10-day quarantine is an effective way to detect rabies in these animals.

Wild animals may be classified as high or low risk. **High-risk wild animals** are those that commonly carry rabies. In New Jersey, these include raccoons, skunks, foxes, groundhogs (woodchucks) and bats. Since viral shedding periods are not known for these animals, quarantine is not appropriate for these animals, and they must be euthanized and submitted for rabies testing when a bite or exposure occurs. In most cases when these animals are unavailable for testing they must be assumed to be rabid. **Low-risk wild animals** almost never carry rabies. These include small animals such as mice, squirrels, chipmunks, and wild rabbits. Bites by these animals almost never require rabies vaccination unless the circumstance surrounding the exposure was highly unusual (for instance, an unprovoked bite). Bites by trapped mice and rats, by squirrels being fed, by chipmunks and other animals captured by cats or dogs, are considered provoked, and prophylaxis is rarely warranted after such a bite. Post-exposure treatment decisions on **exposure to other animals (beaver, opossum, coyotes, etc.)** are made on a case-by-case basis. Refer to the *New Jersey Guide To Post-exposure Rabies Treatment For The Health Care Professional* for more information.

If the biting animal is found to be positive for rabies, humans who were exposed to the infected animal's saliva through a bite, scratch or mucous membrane should receive post-exposure prophylaxis (PEP) as soon as possible.

Bats pose a unique problem. The bite or scratch of a bat can be so small that it may be undetected. Persons who awaken to find a bat in their room, or small children who have been alone with a bat in a room may require PEP. If an exposure cannot be ruled out and the bat is unavailable for testing, PEP should be given. For more information refer to the *New Jersey Guide To Post-exposure Rabies Treatment For The Health Care Professional* for more information.

Treatment of Domestic Animals Exposed to a Rabid or Potentially Rabid Animal (N.J.S.A. 26:4-82 through 86)

N.J.S.A. 26:4-78 requires a veterinarian, animal control officer or any person with knowledge of the case to notify the local health officer of an animal known or suspected to be affected with rabies or an animal known or suspected of being bitten or exposed to a known or suspect rabid animal. Dog, cats and other domestic animals exposed to rabies shall be confined and observed for either 45 days (currently vaccinated) or 6 months (currently unvaccinated). Euthanasia may be recommended for unvaccinated animals exposed to rabies. The latest recommendations and requirements concerning the quarantine of animals exposed to rabid or potentially rabid animals can be obtained from the NJDHSS IZDP at 609.588.3121 or 588.7500 or from the *New Jersey Guide To Post-exposure Rabies Treatment For The Health Care Professional* available at the NJDHSS website.

C. Preventive Measures

Control of human rabies relies upon controlling rabies in the animal population and in preventing human exposure to rabid or potentially rabid animals. Therefore, it is important to enforce animal quarantine regulations and licensing requirements, and encourage vaccination of cats and other domestic animals.

Personal Preventive Measures/Education

The following will help prevent rabies:

- Vaccinate pets; dogs are required by law to be vaccinated and licensed. Although not required by law, vaccination of cats, ferrets, other pets and livestock is strongly encouraged. Vaccination of domestic animals will create a protective barrier between humans and rabid wildlife.
- Do not feed or handle wild or stray animals. Avoid sick or strangely acting animals.
- Do not keep wild animals as pets. This is illegal as well as dangerous.
- Cover your garbage cans and keep pet food indoors so that wild animals are not attracted to it.
- Do not touch or handle dead animals. Wear gloves when handling animal carcasses.
- Contact the local animal control officer concerning all stray domestic animals or ill or strangely acting wild animals. The public should be discouraged from capturing these animals.
- Never handle bats. A bat bite or scratch may be so small as to go unnoticed. People, who awaken to find a bat in their room, or children, awake or asleep, who have been alone with a bat in a room may require PEP. Bats found in homes should be captured by an animal control officer and submitted for rabies testing.
- When handling a pet that was very recently fighting with or bitten by a wild or potentially rabid animal, avoid handling the animal until its fur is dry. If the animal must be handled, the handler should wear gloves, and use soap and water to clean the wound to avoid human exposure to the attacking animal's saliva.
- Travelers to developing countries with enzootic rabies should receive pre-exposure prophylaxis if they are going to be in situations where exposure is likely (*e.g.*, camping, hiking, backpacking or away from areas where they would be able to receive treatment for a bite wound). Travelers should be warned to avoid petting or having other contact with stray or wild animals.

Note: For more information regarding international travel and rabies, contact the CDC's Traveler's Health Office at (877) 394-8747 or through the Internet at http://www.cdc.gov/travel/

The local health department should:

- Receive and investigate animal bite reports.
- Receive reports of human post-exposure prophylaxis and assist health care providers in ensuring completion of the treatment according to the prescribed schedule.
- Receive and investigate reports of suspect cases of animal rabies and domestic animal exposures to rabies.
- Issue and enforce animal confinement orders.
- Assist veterinarians, animal control officers and private citizens with preparing and submitting specimens to the PHEL Rabies Laboratory.
- Help enforce pet licensing vaccination laws and encourage livestock vaccination.
- Conduct rabies education and awareness efforts within your town.

Note: Rabies educational materials for the public (*e.g.*, brochures and pamphlets) are available from the NJDHSS IZDP at 609.588.3121 or 609.588.7500. Information regarding rabies can also be found on the NJDHSS website.

ADDITIONAL INFORMATION

A *Rabies fact Sheet* can be obtained at the NJDHSS website. Click on the "Topics A to Z" link and scroll down to the subject of rabies.

The following is the formal CDC case definition for human rabies. It is provided **for your information only**; it is not necessary to use this information for reporting or investigating a case. CDC case definitions are used by state health departments and CDC to maintain uniform standards for national reporting. For reporting a case to the NJDHSS, always use the criteria outlined in Section 2 A of this chapter.

Clinical description
Rabies is an acute encephalomyelitis that almost always progresses to coma or death within 10 days after the first symptoms.

Laboratory criteria for diagnosis

- Detection by direct fluorescent antibody of viral antigens in a clinical specimen (preferably the brain or the nerves surrounding hair follicles in the nape of the neck), or
- Isolation (in cell culture or in a laboratory animal) of rabies virus from saliva, cerebrospinal fluid (CSF), or central nervous system tissue, or
- Identification of a rabies-neutralizing antibody titer ≥5 (complete neutralization) in the serum or CSF of an unvaccinated person.

Case classification
Confirmed: a clinically compatible case that is laboratory confirmed.

REFERENCES

CDC. Case Definitions for Infectious Conditions under Public Health Surveillance. MMWR. 1997; 46:RR-10.

CDC. Human Rabies Prevention—United States, 1999, Recommendations of the Advisory Committee on Immunization Practices (ACIP), MMWR. January 8, 1999; 48:RR-1.

CDC. Website Rabies available at http://www.cdc.gov/ncidod/dvrd/rabies

Chin, J., ed. Control of Communicable Diseases Manual, 17th Edition. Washington, DC: American Public Health Association, 2000.

Krebs, J., et al. Rabies Surveillance in the United States during 1998. JAVMA. December 15, 1999; 215:12.

Massachusetts Department of Public Health, Division of Epidemiology and Immunization. Guide to Surveillance and Reporting. Massachusetts Department of Public Health, Division of Epidemiology and Immunization, January 2001.

National Association of State Public Health Veterinarians, Inc. Compendium of Animal Rabies Control, 2001.